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IS 5267 (2002): Vocabulary of Gear Terms - Definitions Related to Worm Gear Geometry [PGD 31: Bolts, Nuts and Fasteners Accessories]



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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
गियर शब्दों की शब्दावली — वर्म विषय ज्यामिती
से संबंधित परिभाषाएं
(पहला पुनरीक्षण)

Indian Standard

VOCABULARY OF GEAR TERMS — DEFINITIONS
RELATED TO WORM GEAR GEOMETRY
(*First Revision*)

ICS 01.040.21; 21.200

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with ISO 1122-2 : 1999 'Vocabulary of gear terms — Part 2: Definitions related to worm gear geometry' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Gears Sectional Committee and approval of the Basic and Production Engineering Division Council.

This standard was originally published in 1969. This revision of the standard has been made by adoption of ISO 1122-2 : 1999 under dual numbering system.

The general definition of gears, vocabulary related to cylindrical gears, gear pairs, trains of gears, bevel gears, hypoid gears, etc, except worm gears have been covered in IS 2458 : 2001 'Vocabulary of gear terms — Definitions related to geometry (*first revision*)'.

The text of the ISO Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.
- c) Only English language text in the International Standard has been retained while adopting it in this Indian Standard.

Indian Standard

VOCABULARY OF GEAR TERMS — DEFINITIONS RELATED TO WORM GEAR GEOMETRY (First Revision)

SCOPE

This part of ISO 1122 contains the part of the international vocabulary of gears which is devoted solely to geometrical definitions of worm gears.

It gives, for each of the geometrical terms relative to gears, a standard definition which will be valid internationally, the corresponding term being chosen as far as possible in each language in such a way as to be a direct reflection of the meaning of the definition.

NOTE Since the choice of the corresponding term can only be partially fulfilled in any particular language, due to the necessity of respecting certain established conventions, it is advisable, as far as translation into other languages is concerned, to refer always to the meaning of the definition itself, rather than to a simple transposition of the original term.

1 DEFINITIONS

1.1 General

1.1.1 Toric surfaces and lines

1.1.1.1 toroid

solid or surface of revolution, generated by the rotation of a circle (the generant), about an axis (the toroid axis) external to the circle and situated in its plane

See Figure 1.

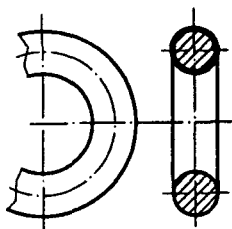


Figure 1

1.1.1.2 generant of a toroid

one of the two circles formed by the intersection of the toroid with any plane passing through the toroid axis

See Figure 2.

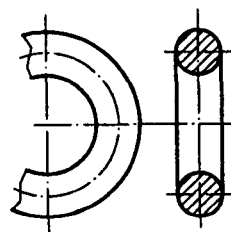


Figure 2

1.1.1.3 mid-plane of the toroid

plane of symmetry of the toroid, perpendicular to its axis

See Figure 3.

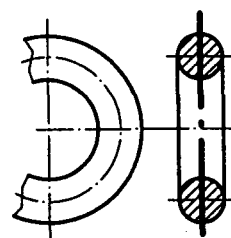


Figure 3

1.1.1.4 mid-circle of the toroid

circle described in the mid-plane of the toroid by the centre of its generant

See Figure 4.

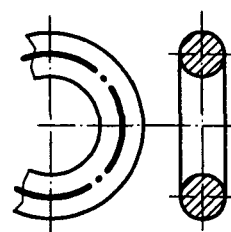


Figure 4

1.1.1.5 inner circle of the toroid

smaller of the two circles of intersection of the toroid by its mid-plane

See Figure 5.

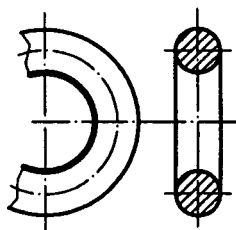


Figure 5

1.1.2 Terms for worm gear pairs and their wheels

1.1.2.1 (cylindrical) worm¹⁾

cylindrical helical gear with one or more threads

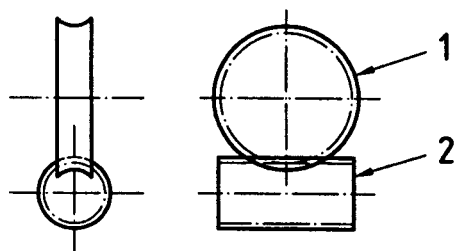
1.1.2.2 (single enveloping) wormwheel¹⁾

gear whose tooth flanks are capable of line contact with those of a cylindrical worm, when meshed as a pair (see 1.1.2.3)

1.1.2.3 (single enveloping) worm gear pair¹⁾

worm and wormwheel meshed together with crossed axes

See Figure 6.



Key
1 Wheel
2 Worm

Figure 6

1.1.2.4 enveloping worm

worm with one or more helical threads, of which the tip and root surfaces are parts of toroids coaxial with the worm, the radii of their mid-circles being co-incident with and equal to, the centre distance of the crossed axis gear pair

1.1.2.5 double-enveloping wormwheel

gear whose tooth flanks are capable of line contact

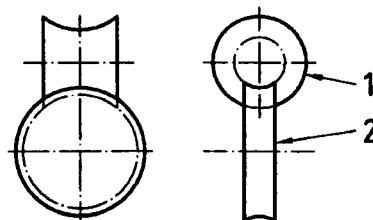
¹⁾ The qualifications "cylindrical" and "single enveloping" are only required when possible confusion between these definitions and enveloping "respectively double enveloping" might otherwise arise.

with those of an enveloping worm, when meshed together with crossed axes

1.1.2.6 double-enveloping worm gear pair

enveloping worm and its mating double enveloping wheel meshed together with crossed axes

See Figure 7.



Key
1 Worm
2 Wheel

Figure 7

1.2 (Cylindrical) worm

1.2.1 Reference elements

1.2.1.1 thread

tooth of a worm

NOTE A worm may have one or more threads.

1.2.1.2 reference cylinder

reference surface of a worm on which the nominal thread dimensions are defined

See Figure 8.

NOTE Its diameter is the nominal worm diameter.

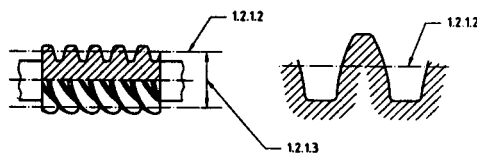


Figure 8

1.2.1.3 reference diameter

diameter of a reference cylinder

See Figure 8.

1.2.1.4 reference helix

helix of intersection of a thread flank with the reference cylinder

1.2.1.5 worm facewidth

length of the threaded part of the worm at the reference cylinder, measured parallel to the axis

See Figure 9.

NOTE The length is that which is actually usable and is denoted by its flanks being completely formed.

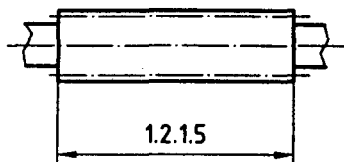


Figure 9

1.2.1.6 lead angle of worm

lead angle of reference helix (see 1.2.2.4)

See Figure 10.

NOTE Its tangent is equal to the ratio between the number of threads and the diameter quotient.

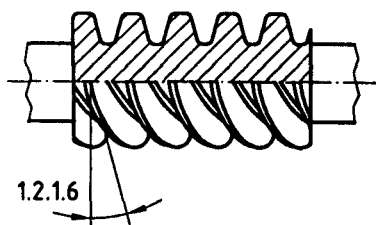


Figure 10

1.2.1.7 axial profile

trace of the intersection of a thread flank by an axial plane

See Figure 11.

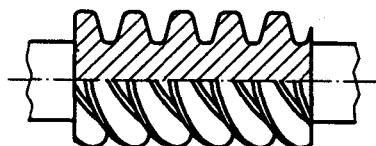


Figure 11

1.2.1.8 transverse profile

line of intersection of a thread flank with a plane which is perpendicular to the worm axis

See Figure 12.

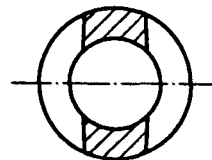


Figure 12

1.2.1.9 offset plane

plane perpendicular to the axis of wormwheel and parallel to an offset from the axis of the worm

See Figure 13.

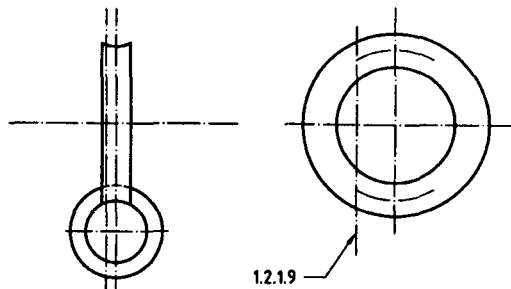


Figure 13

1.2.1.10 rack profile

intersection of a thread flank with a plane parallel to its axial plane

1.2.1.11 normal plane

plane normal to the reference helix

1.2.1.12 normal profile

intersection of a thread flank with a plane normal to the reference helix

1.2.1.13 normal pitch

length of the axis between two corresponding flanks measured along a helix orthogonal to reference helix

1.2.1.14 normal module

quotient of the normal pitch, expressed in millimetres, divided by the number π

1.2.1.15 thread thickness

length of the generatrix of reference cylinder between two opposite flanks of the same thread

See Figure 14.

1.2.1.16 space width

length of the generatrix of reference cylinder between two opposite flanks of two consecutive threads

See Figure 14.

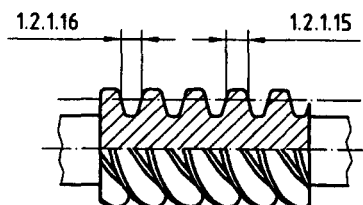


Figure 14

1.2.2 Pitch, addendum, dedendum

1.2.2.1 lead

axial distance between two consecutive corresponding profiles of the same worm thread

1.2.2.2 axial pitch

axial distance between consecutive corresponding profiles of a worm

NOTE The axial pitch is equal to the quotient of the lead divided by the number of threads.

1.2.2.3 axial module

quotient of the axial pitch divided by the number π

1.2.2.4 diameter quotient

quotient of the reference diameter divided by the axial module

1.2.2.5 tooth depth

radial distance between the root cylinder and the tip cylinder

See Figure 15.

1.2.2.6 addendum (value)

radial distance between the tip cylinder and the reference cylinder

See Figure 15.

1.2.2.7 dedendum (value)

radial distance between root cylinder and reference cylinder

See Figure 15.

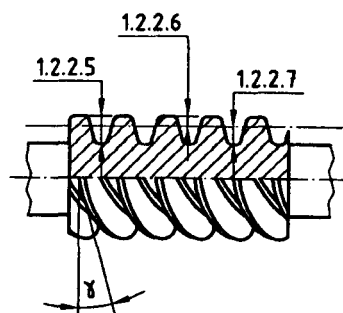


Figure 15

1.2.3 Principal forms of flanks

1.2.3.1 type A

straight axial profile

1.2.3.2 type I

involute helicoidal profile

1.2.3.3 type N

straight profile in a plane normal to the reference helix containing the axis of symmetry of the space width profile

1.2.3.4 type C

concave axial profile produced with a rotary disc type tool with convex circular arc profiles at each side of the periphery

1.2.3.5 type K

convex axial profile produced with a rotary disc type tool in the form of a double cone

1.2.4 Meshing elements

1.2.4.1 pitch plane pitch surface of worm

geometrical surface given by the instantaneous axis of rotation in the relative motion of worm wheel to the worm threads

NOTE This plane is parallel to worm wheel axis and the worm axis.

1.2.4.2 distance between pitch plane and worm axis distance equal to half the pitch diameter

1.2.4.3 pitch diameter

diameter is equal to twice the distance between pitch plane and worm axis

See Figure 16.

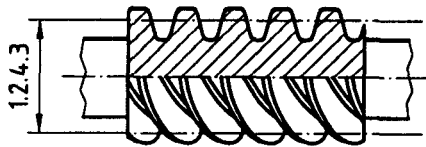


Figure 16

1.2.5 Particular definition for involute worm

1.2.5.1 base cylinder

cylinder coaxial with the worm on which the plane containing the generator of the flank of the worm revolves without sliding

See Figure 17.

1.2.5.2 base helix

helix on the base cylinder to which the straight line generator of the worm thread flank is a tangent

See Figure 17.

NOTE This is also the intersection of the involute helicoid of a flank with the base cylinder.

1.2.5.3 base diameter

diameter of base cylinder

See Figure 17.

1.2.5.4 base angle

lead angle of base helix

See Figure 17.

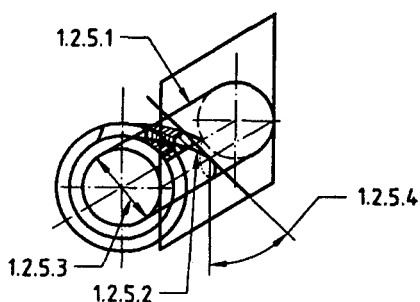


Figure 17

1.3 Single enveloping wormwheels (for shaft angle 90°)

1.3.1 Reference elements

See Figure 18.

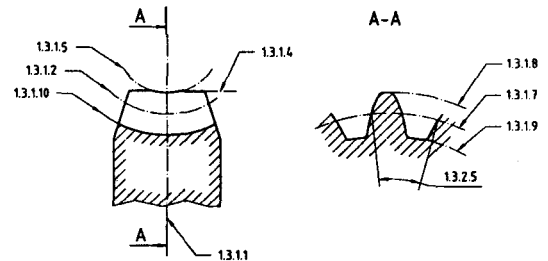


Figure 18

1.3.1.1 mid-plane

plane perpendicular to the wheel axis and containing the axis of the mating worm

See Figure 18.

1.3.1.2 reference toroid

conventional toroid of which the mid-circle radius is equal to the worm/wormwheel centre distance, its axis and mid-plane co-incident with those of the wormwheel and its generant is equal to the reference circle of the mating worm

See Figure 18.

1.3.1.3 outside surface

surface of revolution co-axial with the wormwheel, traced by the external boundaries of the wormwheel teeth, which is composed of a thread form surface and an outside cylinder limited by the width of the wheel

1.3.1.4 outside cylinder

cylindrical part of the outside surface

See Figure 18.

1.3.1.5 throat form surface

toric portion of the outside surface

See Figure 18.

1.3.1.6 root surface

toric surface concentric with the reference toroid

and containing the bottom lands of the tooth spaces

**1.3.1.7
reference circle**

inner circle of intersection of the reference toroid with the mid-plane

See Figure 18.

**1.3.1.8
throat circle**

circle of intersection of the throat form surface with the mid-plane

See Figure 18.

**1.3.1.9
root circle**

circle of intersection of the root surface with the mid-plane

See Figure 18.

**1.3.1.10
root toroid**

toroid tangent to the root surface of the teeth

See Figure 18.

1.3.2 Reference and overall dimensions

See Figures 18 and 19.

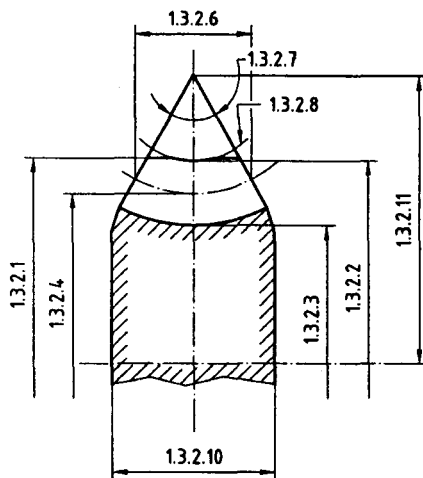


Figure 19

**1.3.2.1
outside diameter**

maximum diameter of the gear blank

See Figure 19.

**1.3.2.2
throat diameter**

diameter of the throat circle at mid-plane

See Figure 19.

**1.3.2.3
root diameter**

diameter of the root circle

See Figure 19.

**1.3.2.4
reference diameter**

diameter of the reference circle

See Figures 19, 20 and 21.

**1.3.2.5
reference pitch**

length of the arc of the reference circle between two consecutive corresponding profiles

See Figure 18.

**1.3.2.6
facewidth**

distance between the two planes containing the circles of intersection of the reference toroid with the end faces of the teeth

See Figure 19.

NOTE When the teeth are symmetrical in relation to the mid-plane, as is usually the case, the facewidth is equal to the chord of the reference generant, between the ends of the teeth.

**1.3.2.7
face width angle**

angle at the centre of the reference generant, subtended by the points of its intersection with the tooth ends

See Figure 19.

**1.3.2.8
throat form radius**

radius of the generant of the tone surface of the throat

See Figure 19.

**1.3.2.9
wheel rim**

rim which contains the wheel teeth

**1.3.2.10
rim width**

maximum axial dimension of the rim

See Figure 19.

1.3.2.11 distance of face width angle

distance between the axis of the worm wheel and the angle point of the face width angle

See Figure 19.

1.3.3 Working elements

See Figure 20.

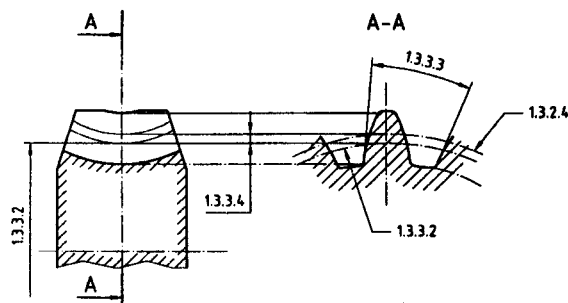


Figure 20

1.3.3.1 pitch circle

(in the mid-plane and concentric with the reference circle) circle at which the pitch of the wormwheel teeth is equal to the axial pitch of the worm

1.3.3.2 pitch diameter

diameter of a pitch circle

See Figure 20.

1.3.3.3 transverse pitch

length of the arc of the pitch circle between two consecutive corresponding profiles

See Figure 20.

NOTE The transverse pitch is equal to the axial pitch of the worm. The transverse pitch is also equal to the product of the module times π .

1.3.3.4 profile shift

half the algebraic difference between the reference diameter and the pitch diameter

See Figure 20.

NOTE It is equal to the specified centre distance, minus half of the sum of the reference diameter of the worm and the pitch diameter of the wheel.

1.3.3.5 profile shift coefficient

quotient of the profile shift divided by the axial module of the worm

1.3.3.6 transverse module

ratio between the transverse pitch and the number π

NOTE It is equivalent to axial module of worm.

1.3.4 Addendum, dedendum

See Figure 21.

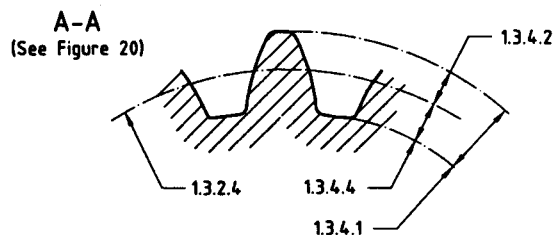


Figure 21

1.3.4.1 tooth depth

half the difference between the throat diameter and the root diameter

See Figure 21.

1.3.4.2 reference addendum²⁾

half the difference between the throat diameter and the reference diameter

See Figure 21.

1.3.4.3 working addendum

half the difference between the throat diameter and the pitch diameter

1.3.4.4 reference dedendum²⁾

half the difference between the reference diameter and the root diameter

See Figure 21.

1.3.4.5 working dedendum

half the difference between the pitch diameter and the root diameter

²⁾ By convention, the qualification "reference" may be omitted as understood unless a clear distinction between "reference" and "operating" is necessary. Use the qualification "tooth reference" when there may otherwise be a risk of confusion with a specially machined datum surface also termed "reference surface"

1.4 Worm gear pairs (single enveloping) (shaft angle 90°)

1.4.1 Gear ratio, depth and clearance

1.4.1.1 gear ratio

quotient of the number of teeth of the wheel divided by the number of threads of the worm

1.4.1.2 working depth

distance, along the common perpendicular to both axes, between the tip surfaces of the worm and the wheel

1.4.1.3 bottom clearance

distance, along the common perpendicular to both axes, between the tip cylinder of the worm and the root circle of the wheel or between the throat circle of the wheel and the root cylinder of the worm

1.4.1.4 circumferential backlash

length of arc of the pitch circle through which a wheel can be turned, from working flank contact to non-working flank contact when the mating worm is fixed

1.4.1.5 normal backlash

shortest distance between non-working flanks when the working flanks are in contact

1.4.1.6 working centre distance

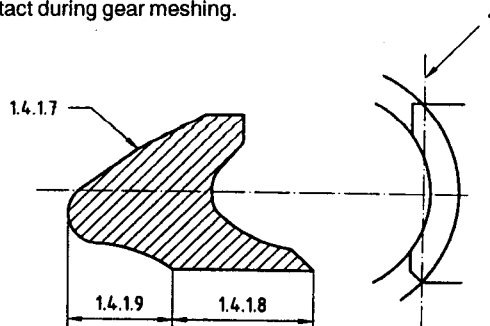
distance between the worm axis and the worm wheel axis

1.4.1.7 zone of contact

geometrical surface defined by contact points between the worm and the worm wheel

See Figure 22.

NOTE This surface is obtained by the successive lines of contact during gear meshing.



Key :
1 Instantaneous axis of rotation

Figure 22

1.4.1.8 approach length

axial distance between the first point of contact of threads, on approach, and the instantaneous axis of rotation when gear is working as reducer

See Figure 22.

1.4.1.9 recess length

axial distance between the last point of contact of threads, on withdrawal, and the instantaneous axis of rotation when gear is working as reducer

See Figure 22.

1.4.1.10 total contact ratio

ratio between the angle of worm wheel rotation corresponding to the limit positions of meshing (begin and end) and the transverse pitch of worm wheel

1.4.2 Worm gear mesh sections

1.4.2.1 worm gear mesh section

section of the mesh of a worm gear pair, by any plane perpendicular to the wormwheel axis

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
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Telegrams : Manaksanstha
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Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	{ 323 76 17 323 38 41
Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022	{ 60 38 43 60 20 25
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Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD.
GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR.
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